The Significance and Role of Exercise to Ninth and Tenth Grade Students

An Honors Thesis (HONRS 499)

by

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Abstract

Coronary artery disease (CAD) is the number one cause of death in the United States. Several modifiable factors increase the risk for CAD including smoking, diabetes, high blood pressure and high cholesterol, obesity, and lack of physical activity. A sedentary lifestyle is a risk factor and contributes to high blood pressure and cholesterol levels, obesity, and may contribute to the development of type 2 diabetes mellitus (Nieman, 1995). Benefits of regular exercise are verified by numerous studies. Habitual exercise reduces the risk of CAD, improves cardiopulmonary functioning, and decreases morbidity and mortality (Froelicher et al., 1995). The American College of Sports Medicine recommends three to five days weekly of aerobic, rhythmical exercise using large muscle groups at 50 to 85% of maximal oxygen uptake for at least 20 minutes per session, yet they also recognize that any physical activity is better than none and more is better than a little, to a degree (Froelicher et al., 1995). Regular exercise decreases high blood pressure and increases high density lipoprotein-cholesterol while also helping maintain ideal body weight and decrease risk of type 2 diabetes mellitus (Nieman, 1995).

Because behavioral patterns are often established during adolescence, the purpose of this study was to investigate current exercise levels of ninth and tenth grade students in Delaware County, Indiana. This study also examined the attitudes and understanding students have about exercise.

The results indicate that 83.4% of the subjects regularly exercise at some level, yet only 30.1% exercise all months of the year. Most of the students (85.2%) feel that their current exercise levels affect their future health. However, only 64% of the students surveyed plan to exercise throughout life.

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Chapter 1
Introduction

Coronary artery disease (CAD) is the leading killer of Americans today (Nieman, 1995). Many factors are involved in CAD including smoking, diabetes, high cholesterol (hypercholesterolemia), high blood pressure (hypertension), obesity, and a sedentary lifestyle (Nieman, 1995). Physical inactivity is a contributing factor to the rising number of overweight and obese children and adults (Popkin & Udry, 1998). Physical inactivity is also related to diabetes, hypertension, and hypercholesterolemia (Nieman, 1995).

Regular physical activity and exercise plays a large role in reducing the risk for the nation's number one killer, CAD, as well as diabetes, hypertension, and some cancers (Savage & Scott, 1998). Dr. Ralph Paffenbarger stated, "Epidemiological studies have left no doubt as to the existence of a strong inverse relationship between physical exercise and coronary heart disease risk," (Nieman, 1995). Long term regular exercise has been recognized by the American College of Sports Medicine (ACSM) to reduce hypertension, high cholesterol, and obesity as well as the risk of diabetes, all of which are risk factors for CAD. A sedentary lifestyle is a risk factor (Froelicher, Mahler, Miller, & York, 1995), and estimates reveal that more than 250,000 deaths each year in the United States can be traced back to lack of regular exercise (Nieman, 1995).

Because lifestyle habits are frequently developed during youth (Shephard and Godin as cited in Klimt, Mocellin, & Rutenfranz, 1986), establishing a regular exercise pattern is important during this time. Only 21.5% of American high school students take physical education (PE) class each day. One study of high school PE students disclosed that only

one-third of the students exercise for at least 20 minutes three to five days weekly, yet another researcher found that 66% of youth ages ten to seventeen engage in regular vigorous physical activity at least three days a week for a minimum of twenty minutes each bout (Nieman, 1995).

Thus, the reason for this study was to examine current exercise habits (and attitudes toward future health and exercise) of ninth and tenth grade students who were enrolled in physical education classes. Research was conducted using surveys at four high schools in Delaware County, Indiana. Physical education classes provided 100% of the subjects. Each student was asked about the components of exercise: frequency, intensity, duration, and mode as well as about their understanding of the connection between exercise and health.

Delimitations

*All of the subjects were freshmen and sophomore students of Delaware County, Indiana.

*The students were in physical education class during the spring 1998 semester when the survey was administered.

*The students did not know about the questions ahead of time.

Limitations

*Honesty of the students.

*Accuracy in recall within the past one month.

*Questions asked.

*Number of subjects (178).

Chapter 2
Literature Review

Research from other scientists is presented in the review of literature. Although the majority of research concerning the benefits of regular exercise concentrates on adults, studies exist revealing the positive effects regular exercise has on children and adolescents. Suggestions and goals for the younger and older generations of Americans are also presented.

Excluding family history, gender, and age, all other risk factors for coronary artery disease are modifiable. Regular exercise reduces the risk of diabetes, obesity, high cholesterol, and high blood pressure (Nieman, 1995). The recommended exercise level for apparently healthy individuals (those with no signs/symptoms and no more than one risk factor for CAD) is to engage in a minimum of twenty minutes of aerobic, rhythmical exercise using large muscle groups at 50 to 85% of one's maximum oxygen uptake three to five days each week (Froelicher et al., 1995). Exercise components include duration, mode, intensity, and frequency, and may combine for effective protection against disease.

Strazzullo et al. revealed that exercise in children is inversely related to blood pressure (as cited in Savage & Scott, 1998). Blood pressure is the force of blood against the walls of the blood vessels (arteries and veins) caused by a pumping heart (Nieman, 1995). Two forces, both of which are measured in mm Hg (millimeters of mercury), are involved in blood pressure: the systolic pressure is the force as the heart contracts, and the diastolic pressure is the force as the heart relaxes. Thus, blood pressure is expressed as a fraction, systolic pressure over diastolic pressure. Ideal blood pressure is systolic pressure < 120

mm Hg and diastolic pressure < 80 mm Hg (Froelicher et al., 1995). Hypertension is defined as systolic > 140 mm Hg or diastolic > 90 mm Hg (Nieman, 1995). Fisher and Brown (1982) showed a meaningful decrease in diastolic blood pressure in seventh graders who exercised for thirty minutes a day, five days a week for twelve weeks (as cited in Binkhorst et al., 1985). Significant correlations between physical activity and diastolic blood pressure have also been confirmed in female children and between overall blood pressure and fitness in female adults (as cited in Buono, Nader, Patterson, & Sallis, 1988). However, Fixler and Brown (1982) found no significant relationship of regular exercise with blood pressure in eighth graders, and only a few studies have found a correlation of physical activity to blood pressure in adolescents (as cited in Binkhorst et al., 1985).

Although the evidence for blood pressure is conflicting in young people, several studies have found a significant relationship between exercise and cholesterol (Nieman, 1995). Protein carriers, called lipoproteins, in the body carry cholesterol and triglycerides (fats). Low density lipoproteins (LDL) carry the most cholesterol while the high density lipoproteins (HDL) are about half protein (Nieman, 1995). A high concentration of LDL, a high total cholesterol (TC), and/or a low concentration of HDL increases the risk for CAD according to the ACSM guidelines (Froelicher et al., 1995). The American College of Sports Medicine defines high TC as >240 mg/dL, high LDL as $\geq$ 160 mg/dL, and low HDL as <35 mg/dL (Froelicher et al., 1995). Total and LDL cholesterol levels are primarily affected by diet while HDL levels are significantly related to exercise; exercise increases the HDL level in the blood (Nieman, 1995). For the overweight and obese, losing weight decreases LDL and TC levels; regular exercise seems to aid in weight reduction when combined with caloric control (Nieman, 1995). Reducing LDL and TC often reduces the risk for coronary artery disease, and a high HDL level protects against CAD, although some research has found significance for females only because females tend to have higher HDL levels than males (Nieman,

1995).

Buono et al. (1988) demonstrated a meaningful correlation between self activity rating and energy expenditure with HDL/LDL levels in female children, which agrees with adult studies. Thorland and Gilliam (1981) also revealed an association between physical activity and increased HDL levels in children of both sexes (as cited in Savage & Scott, 1998). Comparatively, Montoye found that active children maintain higher HDL and HDL:TC ratios than their inactive counterparts (as cited in Binkhorst et al., 1985). However, because these studies provide evidence for children, they can not be automatically applied to adults.

Both blood pressure and cholesterol are significantly impacted by fat weight. Body Mass Index (BMI) seems to successfully identify overweight and obese persons who are at risk of death by diseases related to fat weight (Nieman,1995). Body Mass Index, also referred to as Quetelet Index, is the ratio of body weight in kilograms to the height in meters squared (kg/m2) (Froelicher et al., 1995). This measurement correlates significantly (r=0.70) with body fat measurement using hydrostatic weighing (Nieman, 1995). Overweight and obese individuals are at a much greater risk for hypertension than those that maintain an ideal body weight. As BMI increases so does the risk of high blood pressure (Nieman, 1995). Physical activity was strongly correlated with BMI in male children and male and female adults; the more physically active, the lower the BMI (Buono et al. 1988). They also found a relationship between activity rating, BMI, and HDL cholesterol and/or the HDL/LDL ratio (HDL is higher in more active persons) in three of four subgroups. Other studies agree with Buono et al. (1988). Since long term regular exercise helps maintain an ideal body weight, a healthy BMI is often achieved and maintained. Maintaining a desirable body weight impedes hypertension and hyperlipidemia (Nieman, 1995).

The majority of the evidence above coincides with research on exercise and risk factors for older adults. Research consistently demonstrates that both children and adults who have healthier risk

profiles are physically fit. Fit adults maintain lower risk for morbidity and mortality (Buono et al., 1988). The results infer that increased physical activity is associated with positive effects on lipoproteins, blood pressure, and BMI. However, Montoye did not find the relationship of physical activity or fitness to reduced risk of disease in children (as cited in Binkhorst et al., 1985).

Because of the health benefits of exercise on youth, Shephard and Godin investigated influencing factors for youth who exercise (as cited in Klimt, Mocellin, & Rutenfranz, 1986). Using questionnaires, Shephard and Godin assessed the attitudes of the youth and that of their parents in addition to the interaction of current physical activity levels with past experience in physical activity. Because behavioral patterns such as eating, smoking, and exercising are frequently established during adolescence, Shephard and Godin studied seventh to ninth graders. Those students who had a high intent to exercise greatly differed from those with low intent to exercise concerning their beliefs about the value of exercise and assessing its results. Although attitude and subjective norms were statistically significant factors contributing to exercise in the lives of these youths, prior experience with physical activity and the attitudes of the parents toward exercise influenced the adolescents' exercise intentions to a large degree. Shephard and Godin also found that seventh grade students believe more than ninth grade students that exercise helps them be more physically fit (Godin and Shephard as cited in Klimt et al., 1986). Additionally, girls were more motivated to exercise to "look better" while boys were more motivated by "being healthy" and "having fun" (1986).

Four studies on American youth between 1984 and 1991 increased the public concern and awareness about physical fitness of children and adolescents. Research on youth across the United States was conducted using surveys. The studies, which were the First National Children and Youth Fitness Study (NCYFS, I) (1984), President's Council on Physical

Fitness and Sports School Population Fitness Survey (1985), NCYFS, II, (1987), and Youth Fitness Behavior Survey (1991), found that, in general, American school-aged children were not active or physically fit enough for adequate protection against future chronic diseases. The American College of Sports Medicine recommends at least 20 minutes of aerobic, rhythmical exercise using large muscle groups at 50 to 85% of maximal oxygen uptake three to five days each week to help prevent future chronic diseases (Froelicher et al., 1995).

Gilbert, Hammermeister, Page and Scanlan (1998) used the 1991 Youth Risk Behavior Survey to investigate behaviors of students who participate in school-sponsored sports teams. The survey included 12,272 ninth through twelfth graders in high schools nationally. Approximately 63% of female ninth and tenth graders were not participating on any school based sports team while an estimated 46% of male ninth and tenth graders did not. Although Caucasian students exhibited the greatest school team participation, sports and exercise outside of the school setting were not measured.

Students who do not participate on a school sports team may exercise in other settings. For example, a recent study on 820 seventh through ninth grade students in Indiana showed that 94% of the subjects exercise "at least once per week" (Savage & Scott, 1998). Surveying high school students in PE classes showed that only one-third regularly exercise for a minimum of 20 minutes three to five days weekly (Nieman, 1995). Another survey of twelve to sixteen year old adolescents questioned their activity levels; results revealed that males do more physical activity than females and whites more than non-whites (Aaron, Anderson, Cauley, Dearwater, Kriska, LaPorte, & Olsen, 1993). Ninety-three percent of white males surveyed answered that they do light to moderate activity for thirty minutes three or more days a week, yet 95% of non-whites males do so. However, only 71% of white and 61% of non-white females said they regularly exercise at that activity level (Aaron et al., 1993). Moderate exercise is no more than 60% of one's maximal

oxygen uptake implying that the activity can be "comfortably sustained for a prolonged period of time, that is, 60 minutes. . . ." (Froelicher et al., 1995). The number of students decreased dramatically when asked if they do vigorous activity at least three days each week for no less than twenty minutes per session. Vigorous exercise is defined as greater 60% of maximal oxygen uptake by ACSM (Froelicher et al., 1995). While 59% of white males vigorously exercise for the specified amount of time each week, only 48% of non-white males do the same. Moreover, only 40% of white females and 31% of non-white females stated they are vigorously active for three or more days a week for 20 or more minutes per bout (Aaron et al., 1993).

The National Children and Youth Fitness Studies have demonstrated that American youth have become more overweight since the 1960s (Nieman, 1995). Extra weight over ideal body weight increases the chance for future chronic diseases; ". . .obesity constitutes one of the more important medical public health problems of our time," (Nieman, 1995). Being overweight, over fat, or obese increases the risk of high blood pressure, high cholesterol, and type II diabetes, all of which are risk factors for CAD. Obesity itself is a risk factor (Nieman, 1995). Numerous studies have demonstrated that childhood and adolescent obesity persist into adulthood obesity (Popkin & Udry, 1998). However, regular long term physical activity and exercise may help one lose excess weight and maintain an ideal body weight (Nieman, 1995).

While the number of American overweight youth has increased, the number of students in PE classes, especially at the high school level, has decreased. Only 36% of students in the fifth through twelfth grades go to a physical education class daily. The number declines greatly for juniors and seniors in high school, and only 21.5% of all high school students have PE each day. Moreover, a study of a PE program at a Texas school revealed that 68% of the time the students were not participating in any activity at all (Nieman, 1995).

Because of the increase in the number of people with risk factors leading to disease and the proliferation of sedentary lifestyles in the United States, the U.S. Department of Health and Human Services, Public Health Service created goals in 1990 for the year 2000 for Americans entitled *Healthy People 2000: National Health Promotion and Disease Prevention Objectives.* The "Physical Fitness and Exercise" category listed twelve objectives. Among the twelve was the goal to increase to at least 75% the percentage of youth ages six through seventeen who perform vigorous physical activity for at least twenty minutes per bout three or more times each week; Savage and Scott found 75% of male and 69% of female adolescents perform physical activity at or near this goal (1998). Another objective is to increase to 30% the proportion of all Americans aged six and over who regularly ("preferably daily") perform light to moderate physical activity for a minimum of 30 minutes each day; only 17% did so in 1995 (Nieman, 1995). Although *Healthy People 2000* outlines a goal of only 15% of those six years of age and older who are completely sedentary, the best current estimate of the proportion of people who engage in no physical activity is approximately 24% (Nieman, 1995). However, Savage and Scott (1998) reported 25.3% of male and 41.1% of female youth are sedentary.

The American College of Sports Medicine has also published statements concerning physical fitness (Nieman, 1995). In 1988, ACSM issued suggestions for physical fitness of youth as well as on physical fitness programs designed for youth. Included in the document was the idea, again, of acquiring 20-30 minutes of vigorous activity daily while accentuating the "fun" and "recreational" aspects of exercise (Nieman, 1995). Physical fitness programs, such as PE classes, should be designed to promote life long exercise habits so that individuals obtain and then maintain enough physical fitness for minimal functional ability and improving health. Finally, the focus of physical activity and exercise should not be athletic, but, rather, be health related (Nieman, 1995).

In summary, studies conducted in the 1980s and 1990s have

demonstrated that American youth are not active or physically fit enough to satisfactorily safeguard against future chronic diseases such as CAD (Nieman, 1995). One large study revealed that only one-third of high school PE students regularly exercise (Nieman, 1995) for the recommended amount of twenty minutes three to five days each week (Froelicher et al., 1995). Furthermore, Shephard and Godin found that the parents' views of exercise and each youth's past experience with exercise play a significant role in the exercise behaviors of adolescents (Godin and Shephard as cited in Klimt et al., 1986). Despite the reasons for exercise, regular exercise reduces the risk for CAD and other chronic diseases and conditions by decreasing blood pressure and BMI (Buono et al., 1988) and increasing the HDL levels (Binkhorst et al., 1985). Studies consistently show that physically fit children and adults maintain lower risk for morbidity and mortality (Buono et al., 1988). Because of the small percentage of American adults and children who meet the ACSM recommendations for frequency, duration, intensity, and mode of exercise, *Healthy People 2000* goals were created. Research conducted in the year 2000 should reveal if goals such as 75% of youth between ages six and seventeen are engaging regularly in vigorous physical activity for twenty or more minutes at least three days weekly.

Chapter 3
Methods

Because of the prevalence of increasing sedentary patterns among young Americans, this study focused on ninth and tenth grade students. Research questions were developed, and then a survey was created to answer the questions which are (1) What are the current exercise levels of ninth and tenth grade students in Delaware County, Indiana? and (2) Do ninth and tenth grade students recognize the connection between exercise and the decreased risk of heart disease and certain cancers? The survey questions had to be easily understood and answered by students in the ninth and tenth grade levels while also answering the research questions completely. Twenty quality questions were formed. Two questions were borrowed from each of the MONICA Optional Study of Physical Activity (MOPSA) survey (Jones, 1997) and the Godin Leisure-Time Exercise Questionnaire (Godin, 1997). See Appendix A for survey questions.

Prior to surveying subjects in Delaware County, the questionnaire was pilot tested with a group of study hall students at Lincoln Senior High School in Wayne County, Indiana. The feedback concerning the questions led to a few changes to clarify the types of responses needed to answer the research questions.

During the same time period that the pilot test was conducted, the schools were contacted to gain permission to survey their students. After speaking with the administration, arrangements concerning date and time were made with the physical education instructors of each school. The Muncie Community School Corporation required a form to be filed about the research being conducted. Ninth and tenth grade students from all of the Delaware County high schools were surveyed. Students surveyed attended the high schools of Yorktown, Delta, Southside, and Central. The

instructor and/or the researcher administered the survey while emphasizing the importance of honesty. Although each school expected to provide 50 students, only between forty and fifty students from each school were available, yielding a total of 178 subjects. However, each subject did not answer all the questions.

After collecting the data from the subjects, a rubric was designed to tally the results. Simple statistics were then figured from each question. Because of confusion over who should answer it, only 129 of the 178 students answered question number fourteen; thus, it was disregarded. Consequently, of those who were not currently active as of date surveyed, research does not show who desired to begin an exercise program.

Chapter 4
Results

The American College of Sports Medicine recommends engaging in regular, aerobic, rhythmical exercise using large muscle groups at an intensity of 50-85% of maximal oxygen uptake, three to five days each week for a minimum of twenty minutes per session. For apparently healthy individuals this level of exercise provides adequate protection from CAD (Froelicher et al., 1995). Results from this study show that no less than 46.6% exercise at the recommended level at least part of the year, yet no more than 30.1% do so the entire year. Although 83.4% claimed to exercise regularly, only 44.6% of those exercise 9 to 12 months of the year. Exercising 5 to 8 months and 1 to 4 months of the year are 32.6% and 16.6% of the subjects, respectively. Finally, 5.7% do not exercise any month of the year. See Appendix B for graph of "Percent of Students Exercising in Months." These results reveal that 10.9% of those who answered "no" to exercising regularly must do so for at least part of the year while 38.8% of those answering "yes" must exercise no more than eight months, or 67% of the year.

Information about the subjects' levels of exercise intensity was also acquired through several different questions. They were first asked about their primary mode of sports and exercise which was then classified into categories of vigorous, moderate, or light. They then were given definitions for vigorous, moderate, and light and asked how often they engage in activity of each intensity level. Because increase in heart rate, subjective level of intensity, and breathing normally correlate during exercise, the subjects were then asked about their changes in rate and/or depth of breathing during sports and exercise. Finally, the students

were asked to rank their levels of exercise including intensity and frequency and how often they exercise to work up a sweat in a week. See graphs comparing light, moderate, and vigorous intensity responses (three graphs) in Appendix B.

While 57.9% of the subjects claimed to engage in vigorous sports and exercise, 71% answered that they do vigorous exercise three or more days each week when vigorous was defined by Godin as "heart beats rapidly" (Godin, 1997). Furthermore, 43.8% said they perform moderate sports and exercise, yet 63.3% claimed to engage in moderate exercise three or more days each week when moderate was defined as "not exhausting" (Godin, 1997). Only 3.4% asserted that they engage in light sports and exercise, but 52.9% claimed to participate in light activity at least three days each week where light is defined by Godin as "minimal effort" (1997). See "Comparison of Exercise Intensity Responses" graph in Appendix B.

The question asking about breathing revealed further changes. Only 22.7% experience a large increase in their rate and/or depth of breathing; 56.4% experience a moderate increase, and 20.9% experience little or no change. See graph "Percent of Students Experiencing Change in Rate or Depth of Breathing" in Appendix B. Thus, of the 83.4% of those who claim to exercise regularly, 79.1% undergo a moderate to large increase in breathing which is required to provide adequate protection from coronary artery disease (Froelicher et al., 1995).

However, when they were asked directly how they would rank their own level of exercise, the results changed for those participating in adequate vigorous activity (3+ days/week). Less than half, 46.6%, said they engage in vigorous exercise at least three days a week while 27.5% assert that they do so one to two times a week. Participating in only light activity answered 20.2% of the subjects, and 5.6% obtain no weekly exercise. See graph "Students Own Ranking of Exercise Levels" in Appendix B." Comparatively, during a seven day period 46.9% often exercise long enough to work up a sweat, 49.1% do so sometimes, and 4% do so rarely.

The subjects current frequency (as of date of survey) of sports and exercise was also evaluated. The survey asked the students to recollect the number of weeks in the past month in which they had exercised at least three times each week. Answering each to zero and one week of the past month in which they had exercised for the specified frequency were 6.2% of the subjects. The proportions continued to rise as the weeks did with 15.7% exercising two weeks of the month, 29.8% three weeks, and 42.1% all four weeks.

Besides intensity and frequency, duration of the regular exercise bouts were assessed. A quarter (25%) of the subjects exercise for no more than twenty minutes during a normal routine. However, 31.3% exercise 20-30 minutes, 15.3% for 31-45 minutes, and 28.4% for at least 46 minutes each session. Conclusively, 75% exercise for the recommended minimum of 20-30 minutes. Nevertheless, 74% of the subjects do not set aside a specific amount time each day to exercise; however, 62.4% participate in team sports, either at school or elsewhere.

In addition to cardiovascular endurance assessment, the students' muscular strength and endurance workouts were also investigated. Each student answered these questions. Although 42.7% do not lift weights, 85.4% do some type of muscle endurance exercise without weights such as crunches, push-ups, etc. Furthermore, 9% resistance train one day a week, 13.5% do two days, 20.8% do three days, and 14% do so four to six days each week.

Although the subjects were ninth and tenth grade students, the survey probed their intentions for the future. Even though only 164 answered the question concerning the five year time period following high school graduation, 74.4% claimed they will continue exercising through those years. Comparatively, 64% claimed they will continue to exercise throughout life even when considering further education, career, spouse, children, etc. See graph "Students' Intentions and Understanding of Exercise" in Appendix B.

These proportions suggest that the subjects understand the

importance of exercise as part of a healthy lifestyle; 85.2% feel their current exercise levels affect their future health. However, 38.7% of the subjects have begun a regular exercise routine in the past year but have quit. Greater than half of the students, 54.6%, wish to increase their levels of exercise while 45.4% are happy at their current levels. However, when asked if they would increase their exercise levels based on research that exercise reduces the risk of heart disease and certain types of cancer, 64.9% claim they will elevate their levels of exercise, leaving 35.1% who will remain at their current level. See graph "Possible Future Exercise Levels" in Appendix B.

Chapter 5
Discussion

Due to the protective effect of exercise reducing the relative risk for CAD and some cancers, in conjunction with the entertainment and the increasing labor-saving conveniences technology has produced for Americans, the purposes of this study was to assess the exercise levels of freshmen and sophomore high school students and their understanding of the relationship exercise has to health and disease prevention. Furthermore, their intentions for future exercise were questioned as their value of exercise may be deduced from the answers. Studies continuously show that people of all ages (above six years) who maintain physical fitness through aerobic exercise sustain healthier risk profiles than do sedentary individuals (Buono et al., 1988). Physical inactivity, a risk factor for CAD itself, also contributes to other risk factors: hypertension, hypercholesterolemia, and obesity (Savage & Scott, 1998).

As previously stated 83.4% of the subjects in this study claimed to engage in some amount of regular exercise, which leaves 16.6% who do not. Fortunately though, only 5.7% exercise zero months of the year. More than half, 53.3%, of those who claimed to exercise regularly do not do so for all twelve months of the year. Comparatively, only 42.1% had exercised at least three times a week each week of the past month. These results contrast to other studies discussed in the literature review. Savage & Scott (1998) researched 820 seventh through ninth graders in Indiana, and their results showed that 94% exercise "at least once per week." However, a national survey found that only one-third of high school students regularly exercise for a minimum of twenty minutes three to five days each week (Nieman, 1995). A *Healthy People 2000* objective

is for at least 75% of youth between ages six and seventeen to do vigorous physical activity for twenty or more minutes three or more times each week (Nieman, 1995). Although the results are unclear about the type and intensity of students' exercise, it is evident that the *Healthy People 2000* goal has not been met and much work is needed to reach it.

Exercise intensity answers are contradictory. While 71% assert that they exercise vigorously a minimum of three days each week when vigorous exercise was described by Godin as "heart beats rapidly" (1997), only 46.6% say they vigorously exercise three or more days a week when vigorous was defined as causing "shortness of breath, a rapid heart rate, and sweating" (Jones, 1997). This difference is a significant 24.4%. Furthermore, 79.1% experience a moderate to large increase in their rate and/or depth of breathing, but only 46.9% claimed to exercise long enough to work up a sweat often during a seven day time period.

Therefore, conclusions about exercise levels can not be accurately determined. However, the data suggests that 46.6% to 46.9% of the subjects exercise intensely enough to perspire while 71.0% to 79.1% increase their heart rate and oxygen intake during exercise. Consequently, the 24.1% to 32.5% in question may recognize these increases as more significant than they are, possibly because they are not physically fit. Because 75% of the subjects exercise for at least twenty minutes, but only (nearly) 47% perspire, the intensity for the other 28% may not be as vigorous. Although the proportions vary about intensity, it seems not quite 47% of the subjects exercise vigorously (perspiring and significantly increasing heart rate and rate of breathing) three or more days each week for more than twenty minutes per session. The *Healthy People 2000* goal is for the proportion to be 75% or greater. The subjects of this study are regressing from the 1991 statistic of 66% of youth ages 10 to 17 engaging in this amount of regular activity.

The subjects of this study who engage in regular physical activity are likely to possess healthier risk profiles for CAD than those who are

sedentary. Buono et al., (1988) showed a correlation between physical activity and diastolic blood pressure in female youths and with overall fitness in female adults. A significant relationship exists between regular exercise and HDL cholesterol and the ratio of HDL to total cholesterol in male and female children (Thorland & Gilliam, 1981). Physical activity is also associated with a lower BMI which maintains a healthier risk profile than do higher BMI levels (Buono et al., 1988).

Just as the statistics of various survey questions varied, so do the influencing factors for subjects' exercise. Godin and Shephard (as cited in Klimt et al., 1986) found that how students' parents view exercise is a significant factor in whether the students exercise and to what extent they exercise. Still, the value of exercise is assessed by the students as well. Perhaps those students who regularly exercise vigorously through all twelve months of the year place a high value on exercise themselves and have parents who encourage physical fitness and exemplify it themselves.

Since a *Healthy People 2000* objective is for at least 75% of 6-17 year old individuals to be exercising vigorously three or more days each week for a minimum of twenty minutes per session, Delaware County freshmen and sophomore high school students are not exercising adequately to meet this goal and protect against future harmful diseases such as CAD. Even though 250,000 deaths in the United States can be linked to physical inactivity, this number will rise in future generations unless young Americans begin heeding recommendations from professionals. More people will experience high blood pressure and high cholesterol, and the percentage of overweight and obese Americans will continue to rise.

Consequently, health educators and fitness professionals need to encourage and motivate youth to exercise and help them maintain their exercise programs. The American College of Sports Medicine recommended in 1988 that the "recreational and fun aspects of exercise should be emphasized" (Nieman, 1995), yet, in 1998, 38.7% of the surveyed

students had begun a regular exercise program in the past year but had since quit. Physical education class needs to be mandatory for each grade level through high school, and the classes must teach and promote physical activities that can be continued throughout life. Today too much of the time the students are standing and waiting. The majority of class time, 35-40 minutes, students should be exerting themselves moderately to vigorously in exercises that can be continued conveniently and readily after school is completed. Moreover, students should be taught how to create an exercise program at a health related level (as opposed to fitness related which is more strenuous). However, PE classes are not the only solution. Students need access to various modes of exercise at little or no cost. Parents and health professionals need to develop creative ways for youth of all ages to be regularly involved in physical activity. The school's facilities should be open year round to all students for this purpose. Personally educating and encouraging students may be vital to youth developing healthy lifestyles in the realm of exercise and physical fitness.

Nonetheless, the state of Indiana seems to promote high school sports to a great degree as observed in "Hoosier Hysteria." It is not surprising that over half, 62.4%, of the subjects participate in team sports at school, a club, or elsewhere. Contradictorily though, only 26% responded that they set aside a specific amount of time each day to exercise. Those students who participate on sports teams must not be including practice and game time as a specific, set aside time. Nevertheless, students should be taught how to make time for exercise in a busy schedule and the importance it will have throughout life. Parents should set a good example by making time for regular exercise, exercising and playing with their children, and supporting all physical activity endeavors despite talent level because parents often have a significant influence as demonstrated by Godin and Shephard (as cited in Klimt et al., 1986).

Besides inquiring about cardiovascular endurance, questions were also asked about resistance training. Because of the grade level and age of the students, it was not unexpected to find that 42.7% of the students do not lift weights; however, 57.3% lift weights at least once a week with the majority lifting three days per week. Furthermore, a large portion, 85.4%, of the subjects, claims to do muscle endurance exercise without weights. Because the students have developed muscle strength and endurance programs at a young age, they possibly will continue to perform the exercises throughout life according to Godin and Shephard's research.

Finally, the subjects' value and understanding of exercise were assessed. Nearly three-fourths of them (74.4%), plan to exercise for the first five years following graduation from high school. Although this number seems promising, most likely 100% of the 74.4% will not continue regular exercise during the five year time period even though universities frequently provide free access to fitness rooms. Nonetheless, 25.6% already plan on not being physically active following high school which is nearly a 10% increase from the number not exercising regularly during high school. Another 10% know that they will not exercise after those five years and throughout the remainder of life; 64% of the subjects plan to exercise throughout life. However, 85.2% feel that their current exercise levels affect their future health. Presumably these students understand the connection between exercise and health, yet 21.2% of those who believe exercise affects their health seem not to value exercise or health enough to continue exercising through all stages of life. It seems many people possess the same opinion today; they know exercise is good for them, but they stubbornly resist it. Moreover, 14.8% do not feel their current exercise levels affect their future health. Health professionals must realize a portion of the population will not value and/or understand the benefits of exercise. Thus, they should promote exercise through awareness and education at a younger age. Otherwise, the morbidity and mortality of CAD will continue to rise.

Lastly, the survey asked if the subjects want to increase their

exercise levels. When questioned if they are happy with their current levels or if they want an increase, 45.4% are happy while 54.6% desire an increase. After informing them that research shows that exercise decreases the risk of heart disease and certain types of cancers, 64.9% asserted that they would increase their level of exercise while 35.1% would not, suggesting that education does encourage exercise. Likewise, if parents would recognize the significance of exercise and then demonstrate its value by engaging in it regularly, theoretically more of the nation's youth would do so as well.

In summary, these young adults need increasing and continued education and encouragement to exercise at levels that promote "the development and maintenance of cardiorespiratory fitness" (Nieman, 1995). Exercise needs to be valued by the parents to encourage their children to be physically active. Moderate to vigorous activity that can be conveniently continued throughout adult life should consume most of the time in PE classes. Schools should have more accessible facilities to all students, not only those on sports teams. Health professionals, educators, parents, and students need to work together to fight against the conveniences and entertainment of technology by becoming physically active to protect against CAD and other pathologies.

It would be very interesting to study these same subjects at their high school graduation, three years following that commencement, at their ten, twenty, thirty, etc. year class reunions. Likewise, it would be interesting to obtain complete risk profiles on these subjects as they enter middle and old age, and, then, examine how they relate to their exercise patterns. A study researching the significance and role of exercise to the subjects' parents would also be advantageous.

Other studies researched on freshmen and sophomore high school students across the United States would yield significant information as well. Data obtained in the year 2000 about American youth from the U.S. Department of Health and Human Services, Public Health Service

concerning the *Healthy People 2000* objectives will be helpful to exercise professionals.

References

1. Aaron, D. J., Anderson, R. L., Cauley, J. A., Dearwater, S. R., Kriska, A. M., LaPorte, R. E., & Olsen, T. L. (1993). The epidemiology of leisure physical activity in an adolescent population. Medicine and Science in Sports and Exercise, 25 (7), 847-853.

2. Binkhorst, R., Kemper, H. C. G., & Saris, W. (Eds). (1985). Children and exercise, XI, 15. Champaign: Human Kinetics Publishers, Inc.

3. Buono, M. J., Micale, F. G., Nelson, J. A., Roby, J. J., & Sallis, J. F. (1993). Seven day recall and other physical activity self-reports in children and adolescents. Medicine and Science in Sports and Exercise, 25 (1), 99-108.

4. Buono, M. J., Nader, P., Patterson, T., & Sallis, J. F. (1988). Relation of cardiovascular fitness and physical activity to cardiovascular disease risk factors in children and adults. American Journal of Epidemiology, 27 (5), 935-939.

5. Gilbert, L., Hammermeister, J., Page, R. M., & Scanlan, A. (1998). Is school sports participation a protective factor against adolescent health risk behaviors? Journal of Health Education, 29 (3), 186-191.

6. Godin, G., & Shephard, R. J. (1997). Godin leisure-time exercise questionnaire. Medicine and Science in Sports and Exercise, 29 (6), S36-S37.

7. Jones, D. A. (1997). The MONICA optional study of physical activity (MOPSA). Medicine and Science in Sports and Exercise, 29 (6), S162-S169.

8. Klimt, F., Mocellin, R., & Rutenfranz, J. (Eds). (1986). Children and exercise, XII, 17. Champaign: Human Kinetics Publishers, Inc.

9. Nieman, D. C. (1995). Fitness and sports medicine, A health-related approach. (3rd ed.). Mountain View: Mayfield Publishing Co.

10. Popkin, B. M., & Udry, J. R. (1998). Adolescent obesity increases significantly in second and third generation U. S. immigrants: the national longtidinal study of adolescent health. Journal of Nutrition, 128, 701-706.

11. Savage, M. P., & Scott, L. B., (1998). Physical activity and rural

middle school adolescents. Journal of Youth and Adolescence, 27 (2), 245-253.

Appendix A

1. Do you regularly exercise (run, do aerobics, play sports, etc.)? Y or N

2. What is your primary form of exercise if you do so regularly?(please name only one) (examples include running, playing football, volleyball, bicycling, walking, etc.; please write your answer in the space)

_____

3. How often do you engage in the following types of exercise for more than 15 minutes in a 7 day period?* (please respond to a.,b., & c.)

a. Vigorous--heart beats rapidly _____days/wk.
(i.e. running, hockey, football, soccer, basketball, swimming, biking hard, etc.)

b. Moderate--not exhausting _____days/wk.
(i.e. fast walking, tennis, baseball, easy biking, etc.)

c. Light--minimal effort _____days/wk.
(i.e. yoga, archery, easy walking, bowling, etc.)

4. Considering a 7 day period, during your leisure time, how often do you exercise long enough to work up a sweat (heart beats rapidly)?*

a. Often
b. Sometimes
c. Never/Rarely

5. If you do exercise, how many minutes do you exercise at one time?

a. <20 min.
b. 20-30 min.
c. 31-45 min.
d. 46+ min.

6. Do you set aside a specific amount of time to exercise each day? Y or N

7. Do you participate in team sports (at school, club, or else where)? Y or N

8. Check the months in which you exercise regularly.

Jan.	July
Feb.	Aug.
March	Sept.
April	Oct.
May	Nov.
June	Dec.

9. When you do your regular exercise routine, what usually happens to your rate or depth of breathing?**

a. no change
b. small increase
c. moderate increase
d. large increase

10. In the past month, how many weeks did you exercise (moderately to vigorously) at least 3 times per week?

a. 0 b. 1 c. 2 d. 3 e. 4

11.Which of the following 4 exercise categories best describes your level of exercise?**

a. no weekly exercise
b. only light exercise most weeks
c. vigorous exercise for 20 min. once or twice a week
d. vigorous exercise for 20 min. 3 or more times each week

(Vigorous exercise causes shortness of breath, a rapid heart rate, and sweating.

12. How many days of a typical week do you lift weights?

0 1 2 3 4 5 6 7

13. Do you do muscle endurance exercises without weights such as push-ups, crunches, sit-ups, etc. Y or N

14. If you do not currently exercise regularly, would you like to start a workout routine? Y or N

15. In the past 12 months, have you begun to exercise but quit? Y or N

16. If you currently regularly exercise, do you think you will continue to

do so for the first five years after you graduate? Y or N

17. Also, if you currently regularly exercise, do you think you will do so your entire life (if physically possible), even if and when you are married, have a career, kids, etc.? Y or N

18. Do you feel that your current exercise level affects your future health & wellness? Y or N

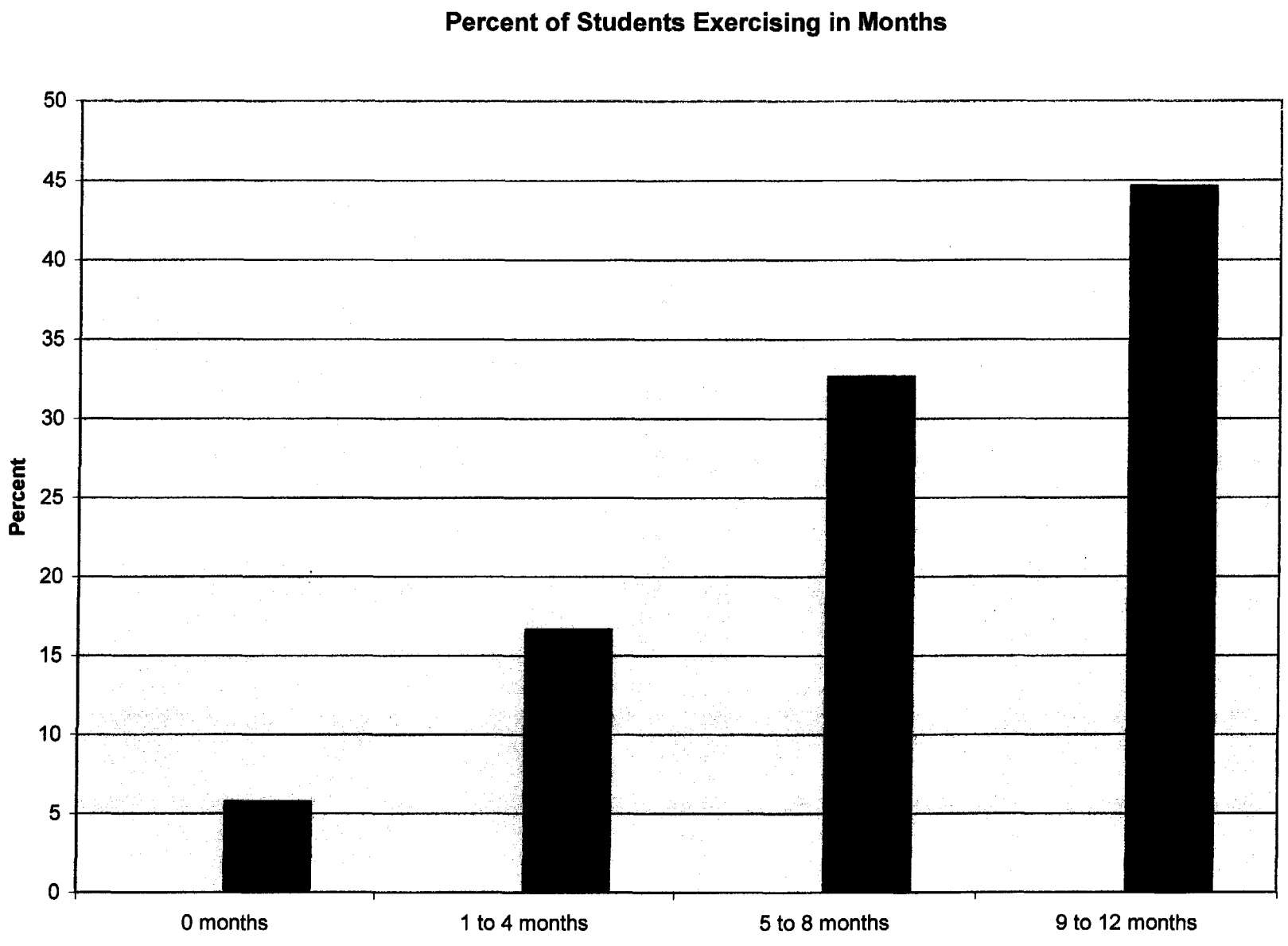
19. Do you want to increase your exercise level or are you happy with what you currently do? Increase Happy

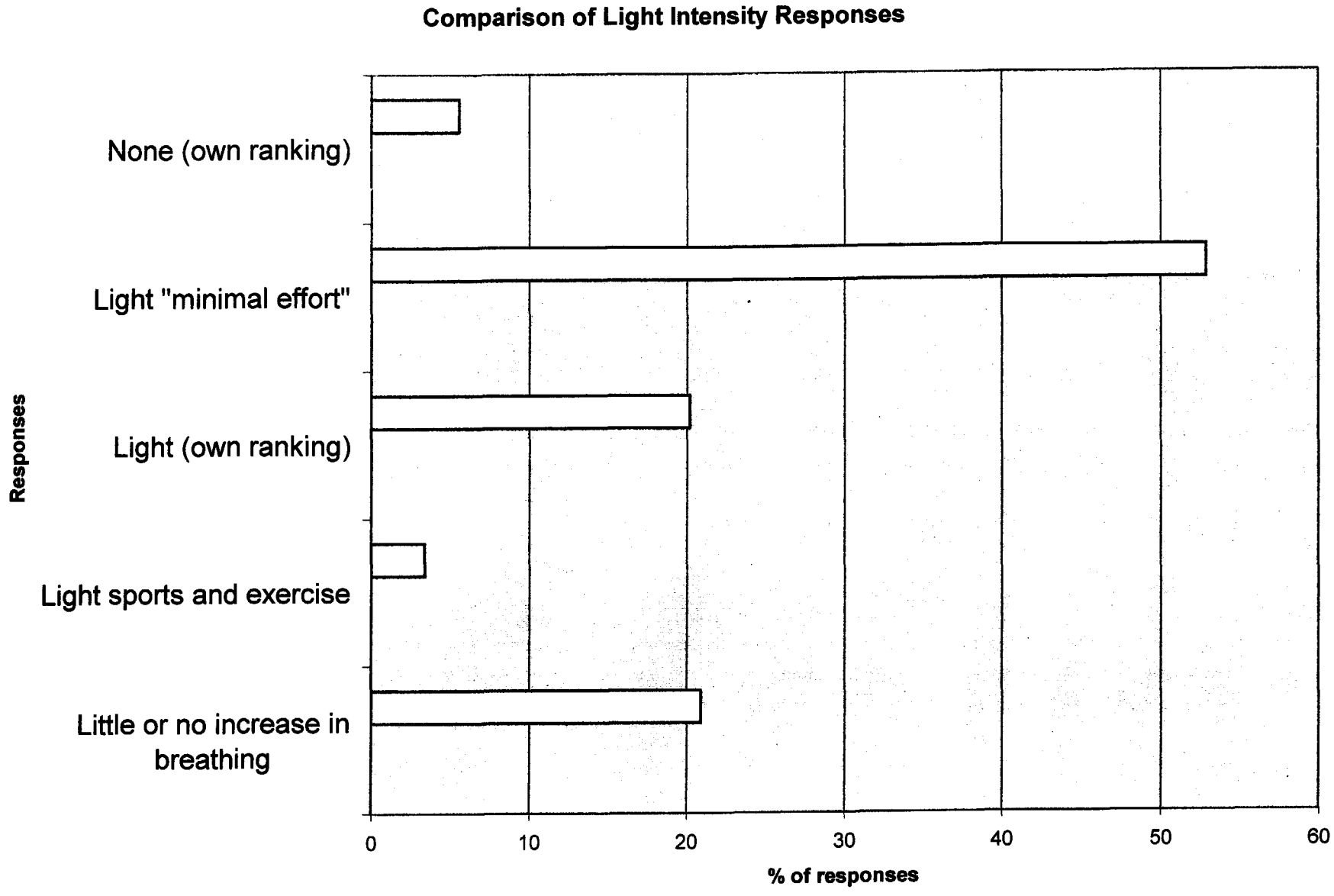
20. Research shows that regular exercise decreases the risk of heart disease and certain types of cancer. Based on this information, will you increase your level of exercise? Y or N

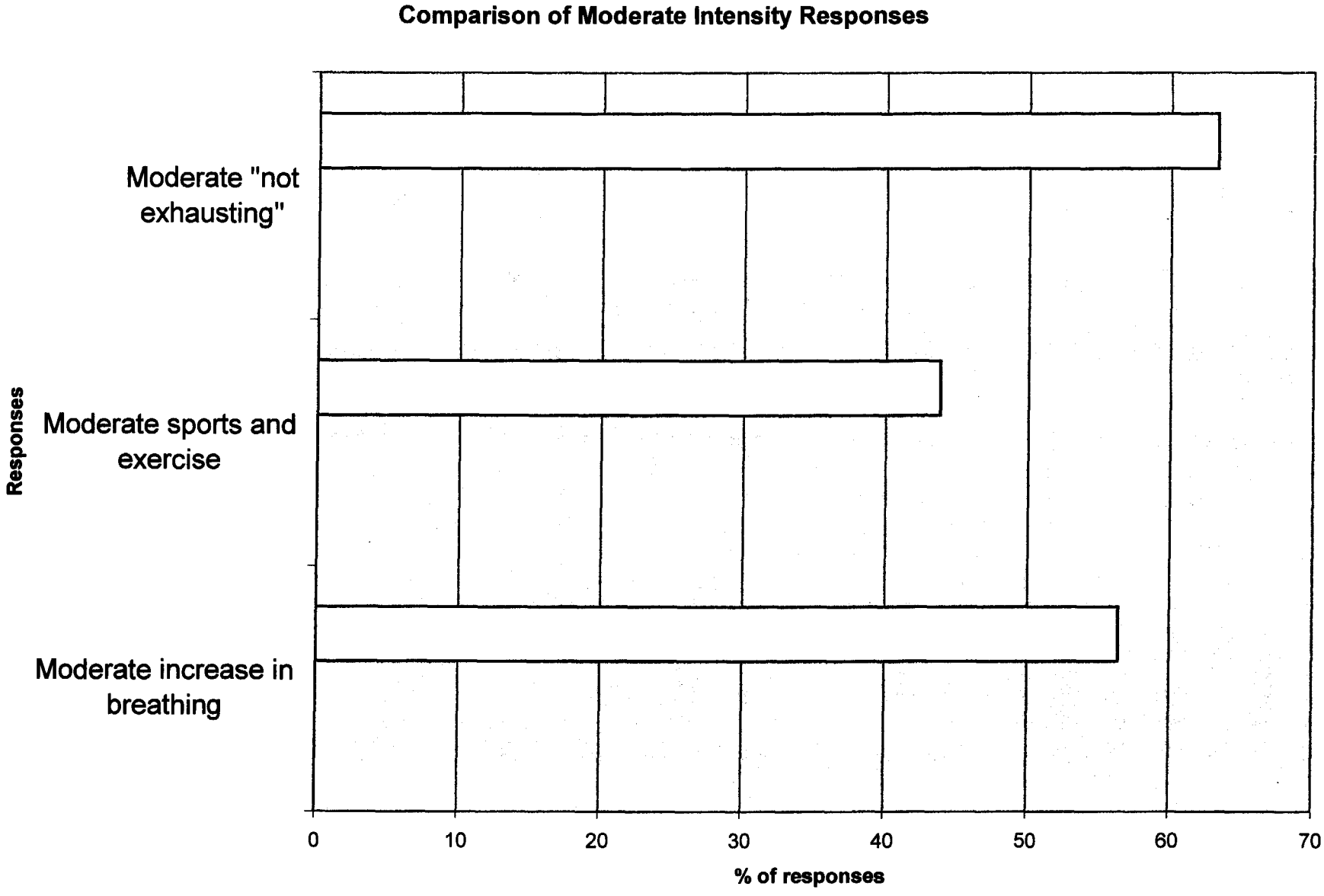
**Godin Leisure Time Health Questionnaire*

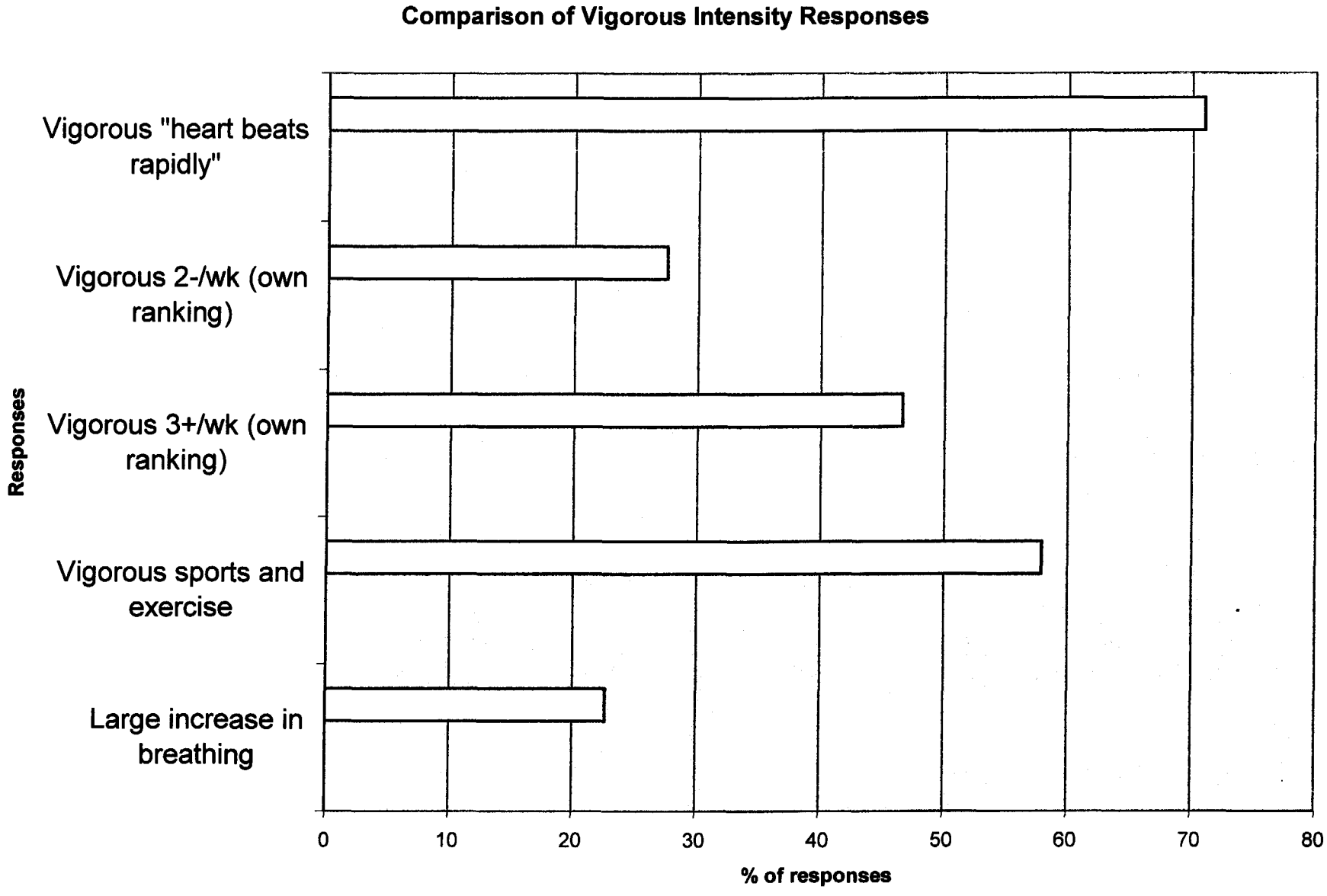
***MOPSA*

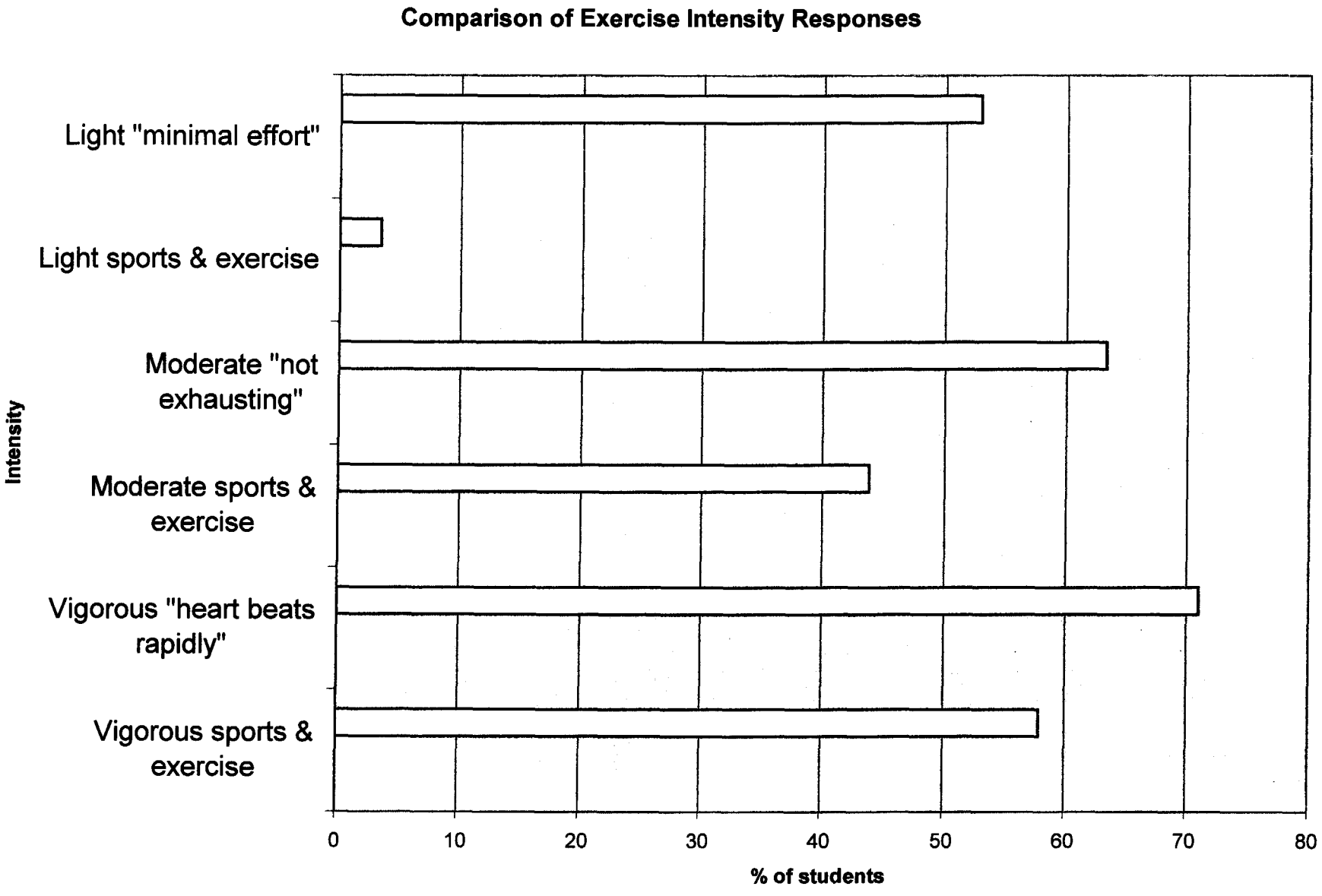
Appendix B

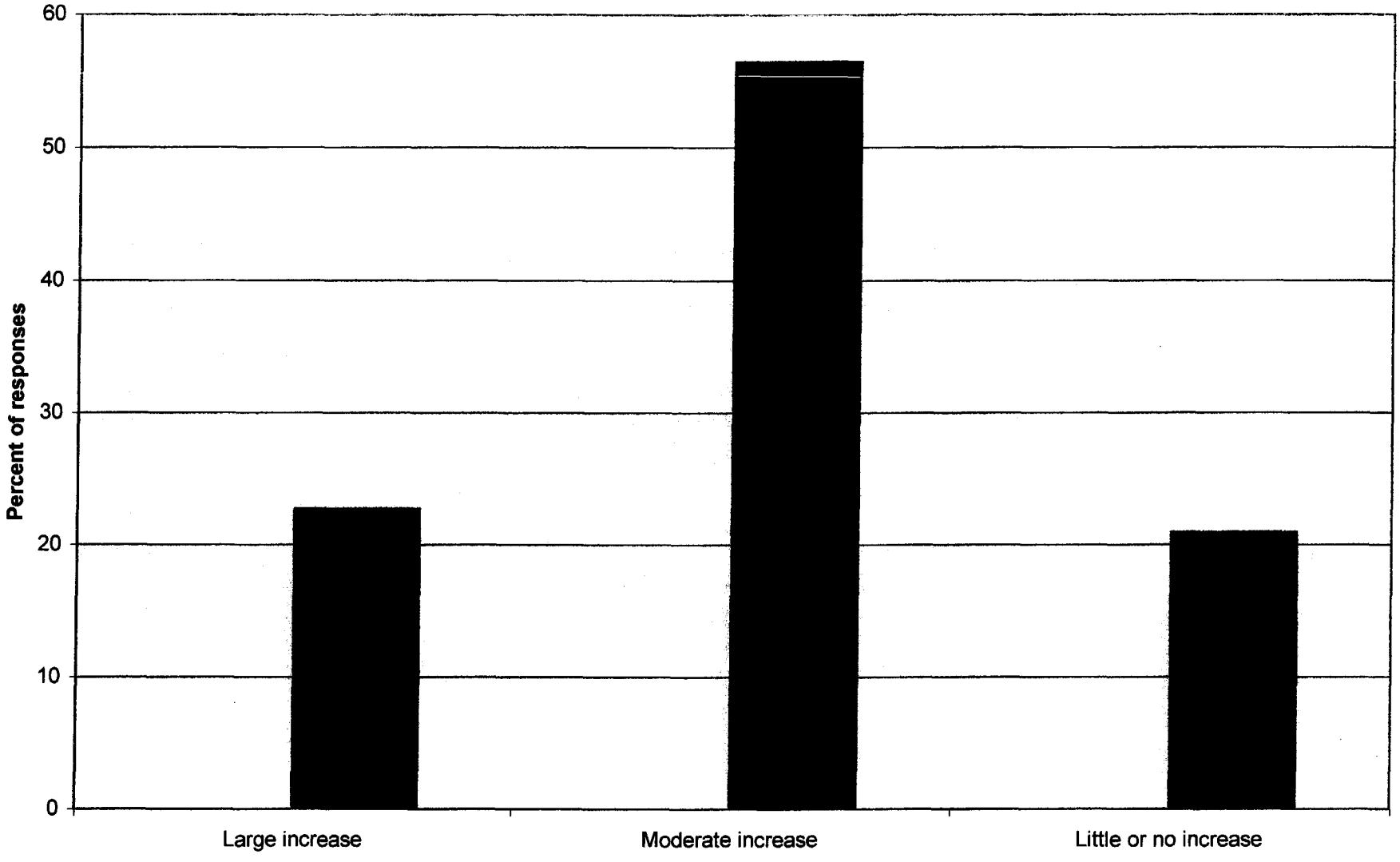

Percent of Students Exercising in Months
Percent
50
45
40
35
30
25
20
15
10
5
0
0 months
1 to 4 months
5 to 8 months
9 to 12 months

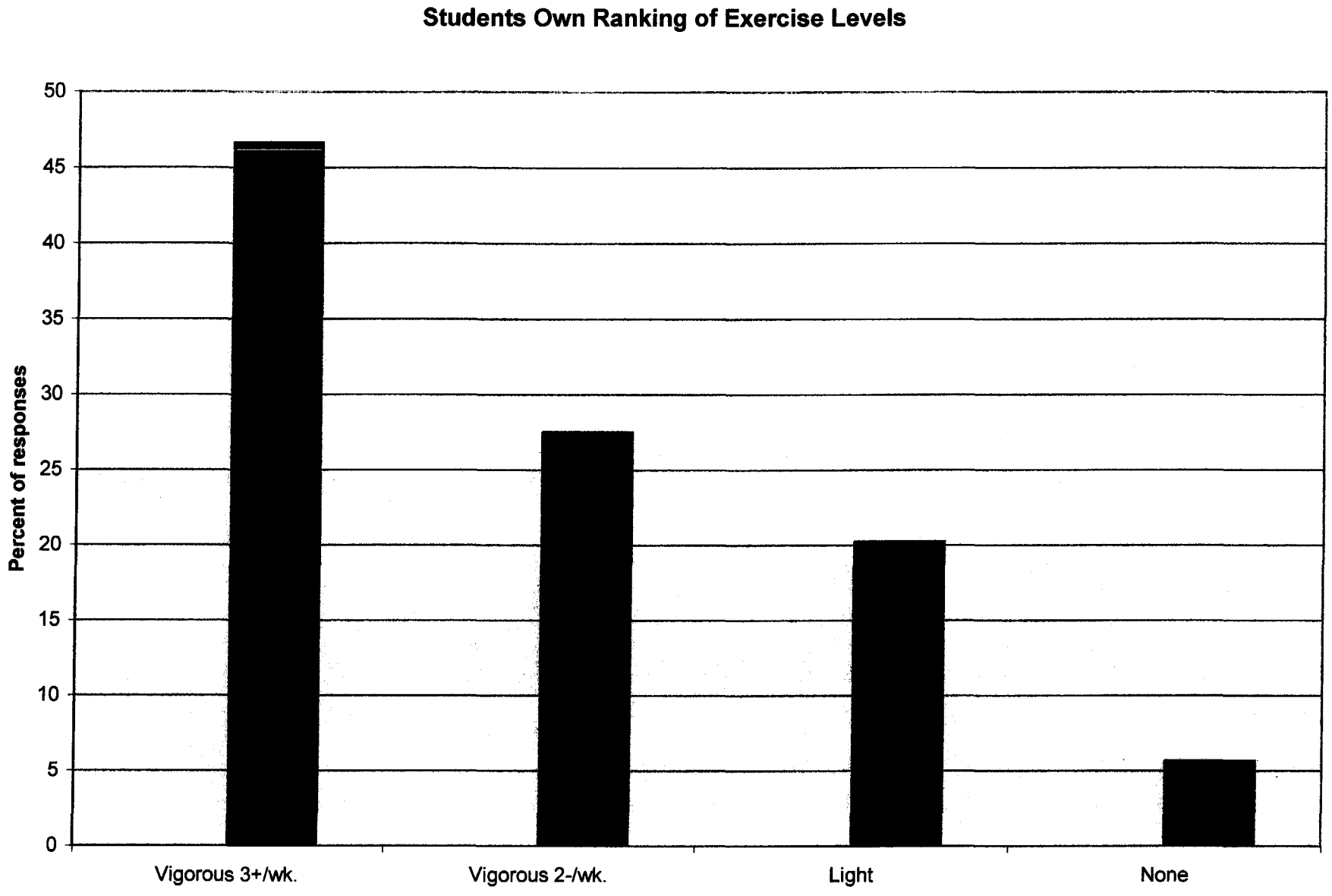

Comparison of Light Intensity Responses
None (own ranking)
Light "minimal effort"
Light (own ranking)
Light sports and exercise
Little or no increase in breathing
Responses
0
10
20
30
40
50
60
% of responses

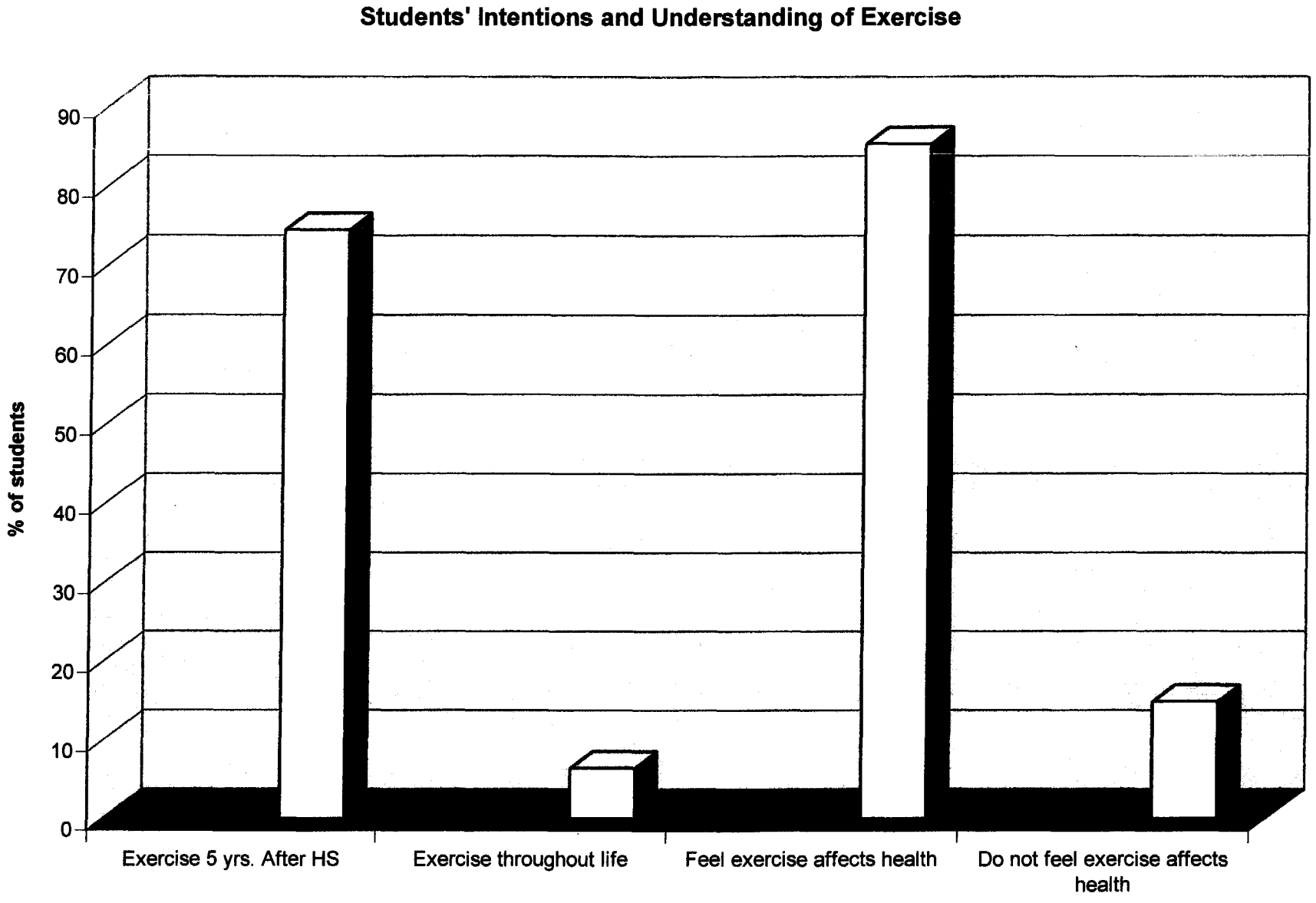

Comparison of Moderate Intensity Responses
Moderate "not exhausting"
Moderate sports and exercise
Moderate increase in breathing
Responses
0
10
20
30
40
50
60
70
% of responses

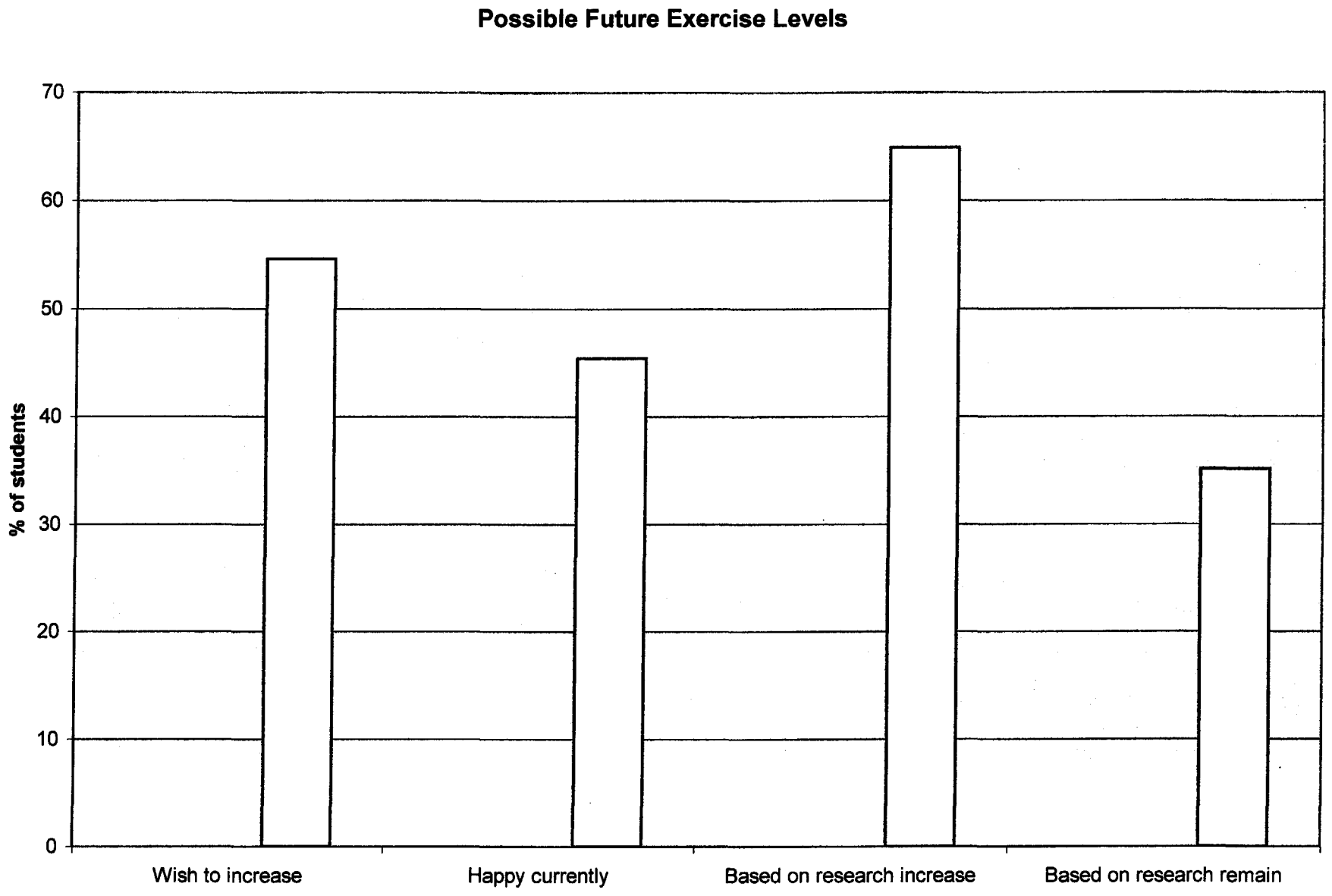

Comparison of Vigorous Intensity Responses
Vigorous "heart beats rapidly"
Vigorous 2-/wk (own ranking)
Vigorous 3+/wk (own ranking)
Vigorous sports and exercise
Large increase in breathing
Responses
0
10
20
30
40
50
60
70
80
% of responses


Comparison of Exercise Intensity Responses
Light "minimal effort"
Light sports & exercise
Moderate "not exhausting"
Moderate sports & exercise
Vigorous "heart beats rapidly"
Vigorous sports & exercise
Intensity
0
10
20
30
40
50
60
70
80
% of students


Percent of Students Experiencing Change in Rate or Depth of Breathing
Percent of responses
60
50
40
30
20
10
0
Large increase
Moderate increase
Little or no increase


Students Own Ranking of Exercise Levels
Percent of responses
50
45
40
35
30
25
20
15
10
5
0
Vigorous 3+/wk.
Vigorous 2-/wk.
Light
None


Students' Intentions and Understanding of Exercise
% of students
90
80
70
60
50
40
30
20
10
0
Exercise 5 yrs. After HS
Exercise throughout life
Feel exercise affects health
Do not feel exercise affects health


Possible Future Exercise Levels
% of students
70
60
50
40
30
20
10
0
Wish to increase
Happy currently
Based on research increase
Based on research remain